Housatonic Water Works Company System Evaluation

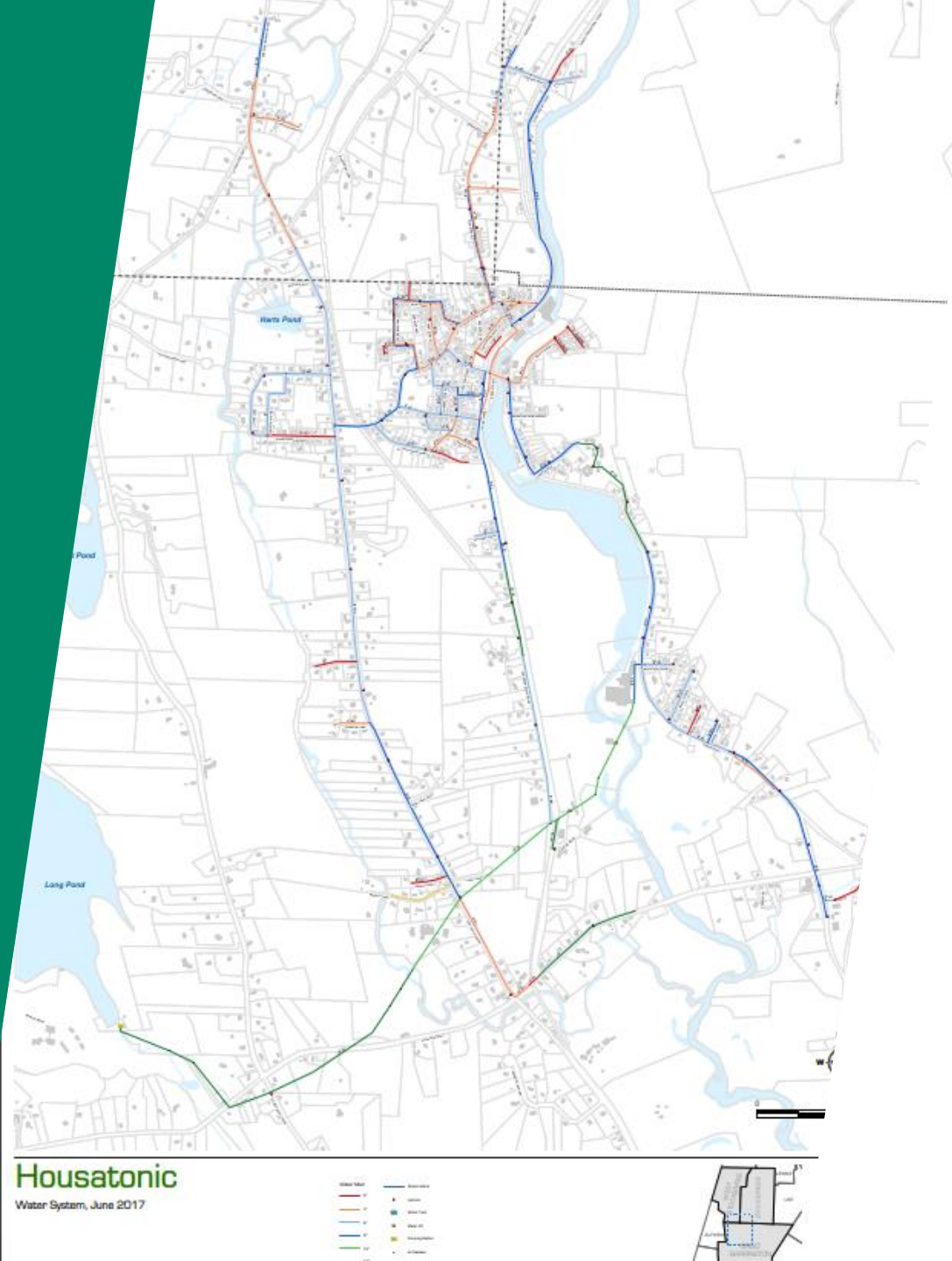
Town of Great Barrington, Selectboard Regular Meeting

July 12, 2021 6:00 PM

AECOM

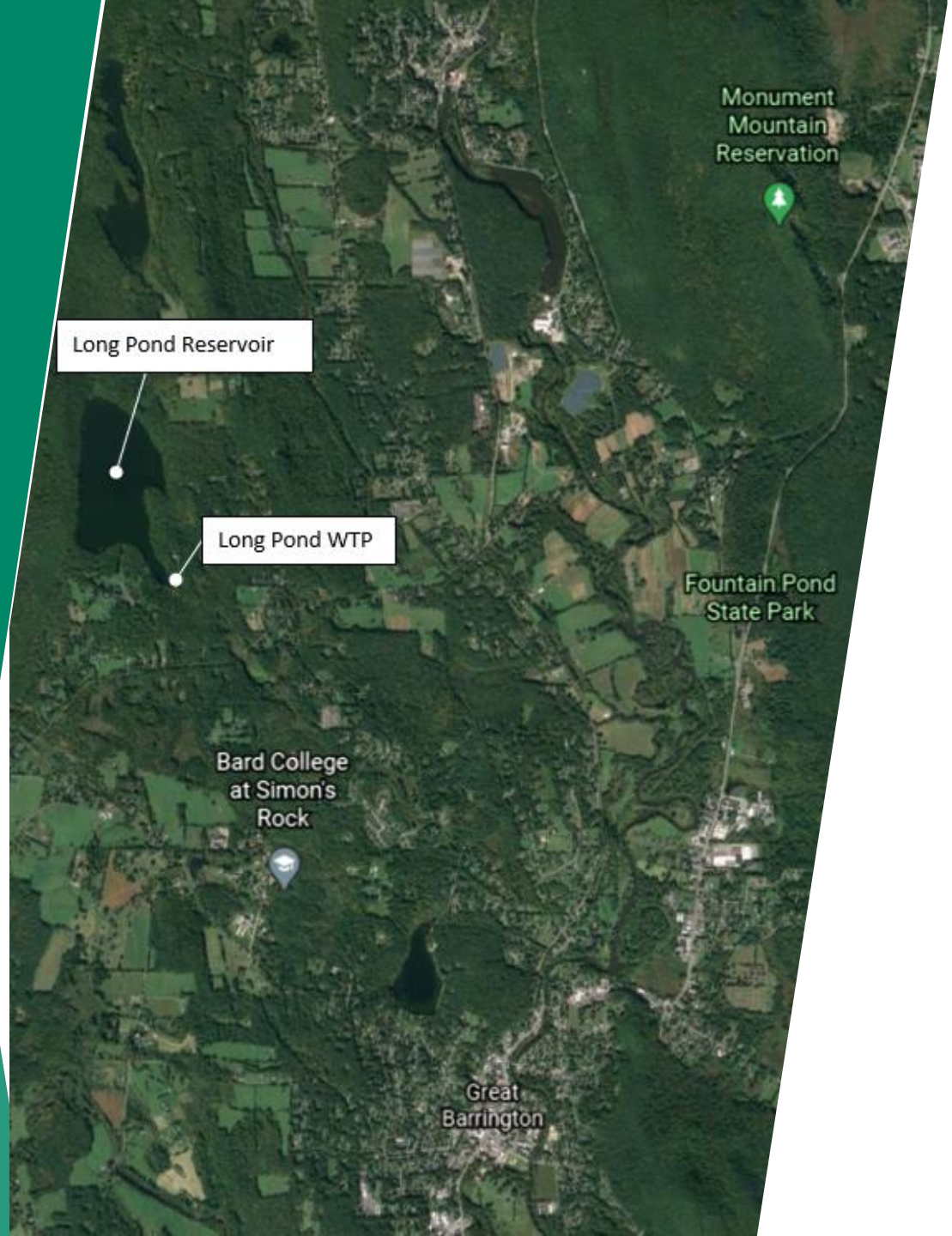
Presentation Outline

1. Introduction
2. Water Supply
3. Water Demand
4. Long Pond Water Treatment Plant
5. Raw and Treated Water Quality
6. Regulatory Compliance
7. Distribution System
8. Recommendations and Capital Improvement Plan



1. Introduction

- Housatonic Water Works Company provides water to 824 services and serves a population of approximately 1,400 residents
- The service area includes residents of the towns of Great Barrington (Village of Housatonic), Stockbridge, and West Stockbridge
- The supply and distribution system are compromised of one surface water source, one drinking water treatment plant, and one finished storage tank



2. Water Supply

- Only water supply is the Long Pond Reservoir
- The Reservoir has a Safe Yield of 0.60 million gallons per day (MGD) and an authorized annual withdrawal volume under the Water Management Act of 0.27 MGD
- Reservoir is naturally formed except for the southern-most section which was excavated for the construction of the earthen dam and spillway in 1902
- There are no connections to any nearby water systems in the event of a water emergency or the Long Pond Reservoir becomes inaccessible.

3. Water Demand

- Water usage is categorized predominately by residential usage (92.1%) with the remainder being commercial, agricultural, industrial, and municipal

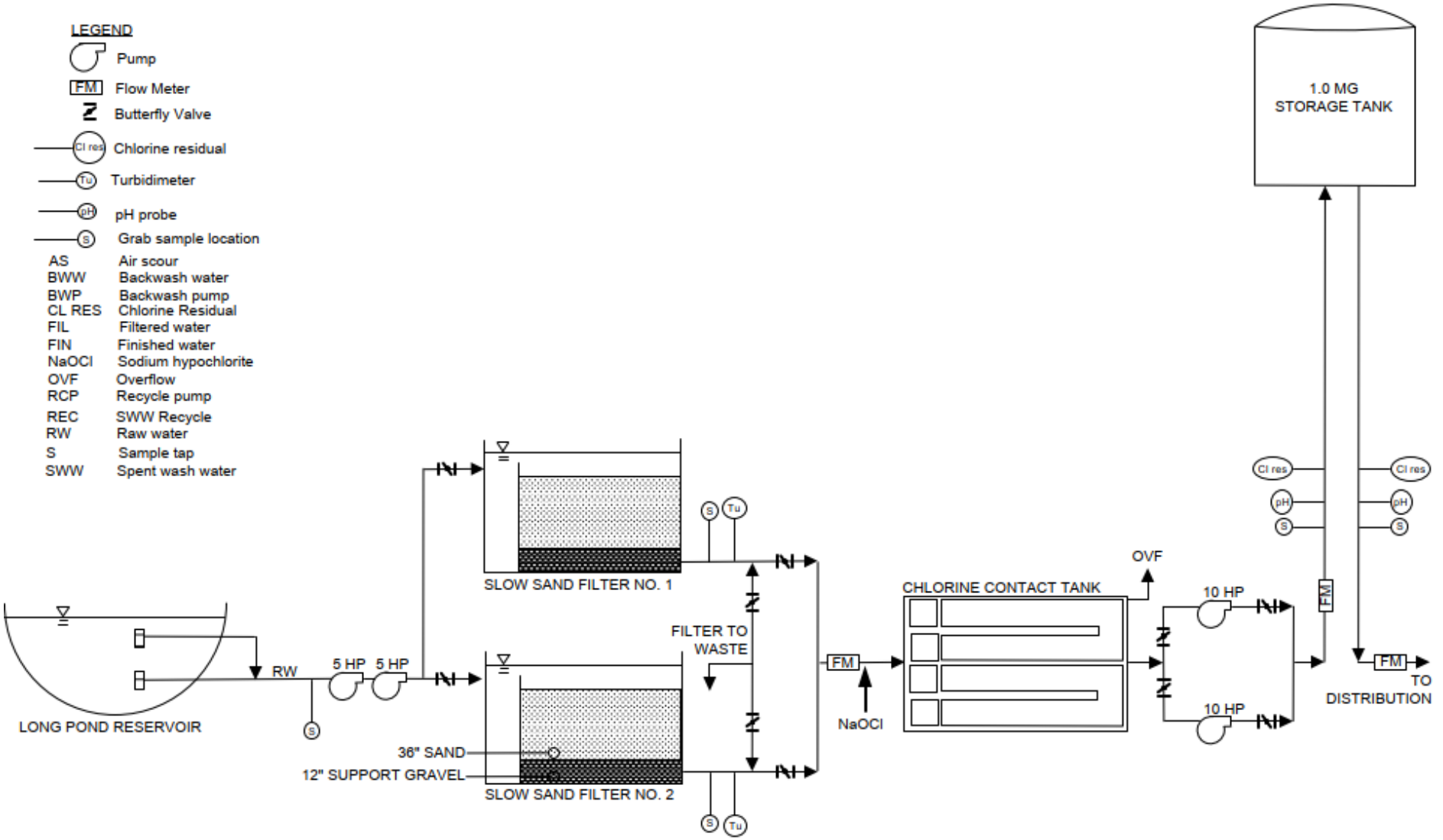
Year	Total Pumped (mgy)	ADD (mgd)[1]	MDD (mgd)[2]	MDD/ADD Peaking Factor
2015	68.03	0.19		
2016	74.84	0.21		
2017	52.84	0.14	0.22	1.57
2018	60.71	0.17	0.30	1.76
2019	55.41	0.15	0.21	1.40
Average	62.37	0.17	0.24	1.44

[1]ADD: Average day demand, rounded to the nearest 0.01 mgd.
[2]MDD: Maximum Daily Raw Water Pumping reported in MassDEP Annual Statistical Report. Only reports from 2017 to 2019 were available.

4. Long Pond Water Treatment Plant

- The Long Pond Water Treatment Plant (WTP) was constructed in 1939 at the southern point of Long Pond
- Long Pond WTP utilizes slow sand filtration, a long-established treatment process that is still widely used
- The WTP was upgraded in 1997 which included the installation of a chlorine contact tank, piping and instrumentation changes, and construction of a 1.0 million gallon storage tank

Long Pond WTP – Existing Process



5. Raw and Treated Water Quality

- Water quality data presented was measured from the last three years (January 2018 through December 2020)
- Maximum Contaminant Level (MCL) = Legal threshold set by the EPA which limits contaminants in public water systems
- Secondary Maximum Contaminant Level (SMCL) = Guidelines for contaminant limits set by the EPA, but are not federally enforceable

Parameter	Units	Long Pond Reservoir (Raw Water)			Compliance Values	
		Average	Minimum	Maximum	MCL	SMCL
Iron	mg/L	0.06	0.05	0.10	-	0.3
Manganese	mg/L	0.019	0.007	0.039	-	0.05
Alkalinity	mg/L as CaCO3	76.3	75.0	77.5	-	-
Color	C.U.	9	1	20	-	15
Total Dissolved Solids	mg/L	109	96	136	-	500
pH	s.u.	8.19	7.60	8.50	-	-
Temperature	^{o}F	65.5	57.4	81.0	-	-
Total Organic Carbon	mg/L	3.28	2.88	4.24	-	-

5. Raw and Treated Water Quality (cont.)

- Generally, the Long Pond WTP produces acceptable water quality
- Turbidity standards are set by the Surface Water Treatment Rule which says slow sand filtration processes must produce water with turbidity less than or equal to 1.0 NTU in at least 95% of measurements and the maximum turbidity must never exceed 5.0 NTU

Parameter	Units	Finished Water Quality			Compliance Values	
		Average	Minimum	Maximum	MCL	SMCL
Iron	mg/L	0.05	0.05	0.05	-	0.3
Manganese	mg/L	0.020	0.002	0.095	-	0.05
Alkalinity	mg/L as CaCO3	79.9	75.0	85.0	-	-
Color	C.U.	9	1	40	-	15
Total Dissolved Solids	mg/L	130	98	436	-	500
pH	s.u.	7.54	7.09	7.94	-	-
Temperature	^{o}F	66.2	43.0	78.3	-	-

6. Regulatory Compliance

- Surface Water Treatment Rule (SWTR) requires a certain amount of removal/inactivation of pathogens such as Giardia and viruses based on disinfection and turbidity removal.
- Turbidity requirements include achieving an effluent turbidity of less than or equal to 1.0 NTU in at least 95% of the measurements taken each month and the maximum turbidity must never exceed 5.0 NTU.
  - Currently Met by the Long Pond WTP
- Removal/inactivation of pathogens is based on log removal "credit" granted by achieving a certain level of disinfection. SWTR requires a 3-log removal of Giardia and a 4-log removal of viruses. Revisions to the SWTR also now require 2-log removal of Cryptosporidium.
  - The slow sand filtration process utilized at the Long Pond WTP is granted some log removal credits provided the turbidity standard is met.
  - Remaining required log removal credits are achieved in clearwell which exposes treated water to chlorine for an extended time

6. Regulatory Compliance (cont.)

- Summary of Log Removal Credits Achieved at Long Pond WTP

Table 4-3: Log Removal Credits Earned by Long Pond WTP

	Log Removal Credits				
	Required by SWTR	From Slow Sand Filtration	From Chlorine Contact Basin	Total Credits Achieved	Notes
Viruses	4.0	2.0	2.0	**4.0**	Achieving 1.0-log removal of Giardia would also achieve a 2.0-log removal of viruses
Giardia	3.0	2.0	1.0	**3.0**	The daily calculated CT is well over the requirements for 1.0-log removal for Giardia.
Cryptosporidium	2.0	2.0	-	**2.0**	Slow sand filtration is assumed by the EPA to achieve a 2.0-log removal of Cryptosporidium.

6. Regulatory Compliance (cont.)

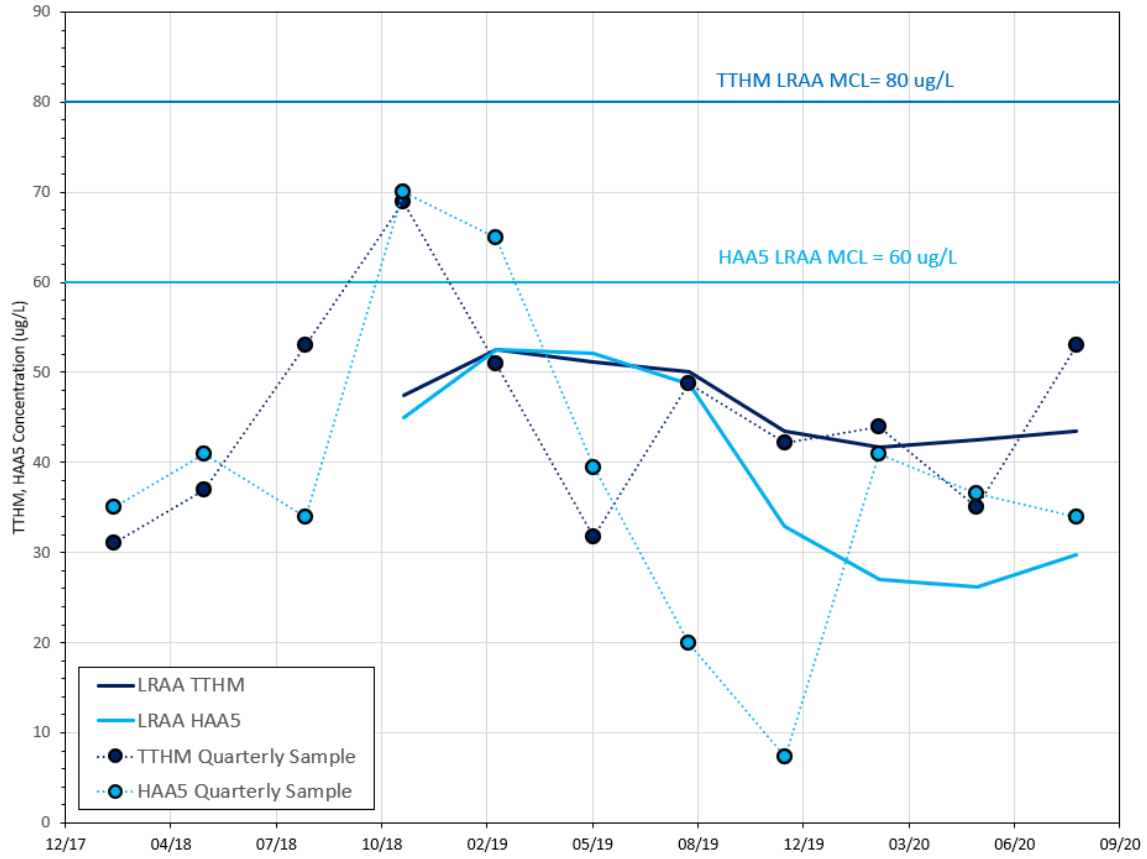
- Lead and Copper Rule
  - There has not been an exceedance of the Action Level for Lead since 2017
  - There has not been an exceedance of the Action Level for Copper since 2018

Figure 4-9: Lead Concentrations Measured in HWWC System (2016 – 2020)

Figure 4-10: Copper Concentrations Measured in HWWC Service Area (2016 – 2020)

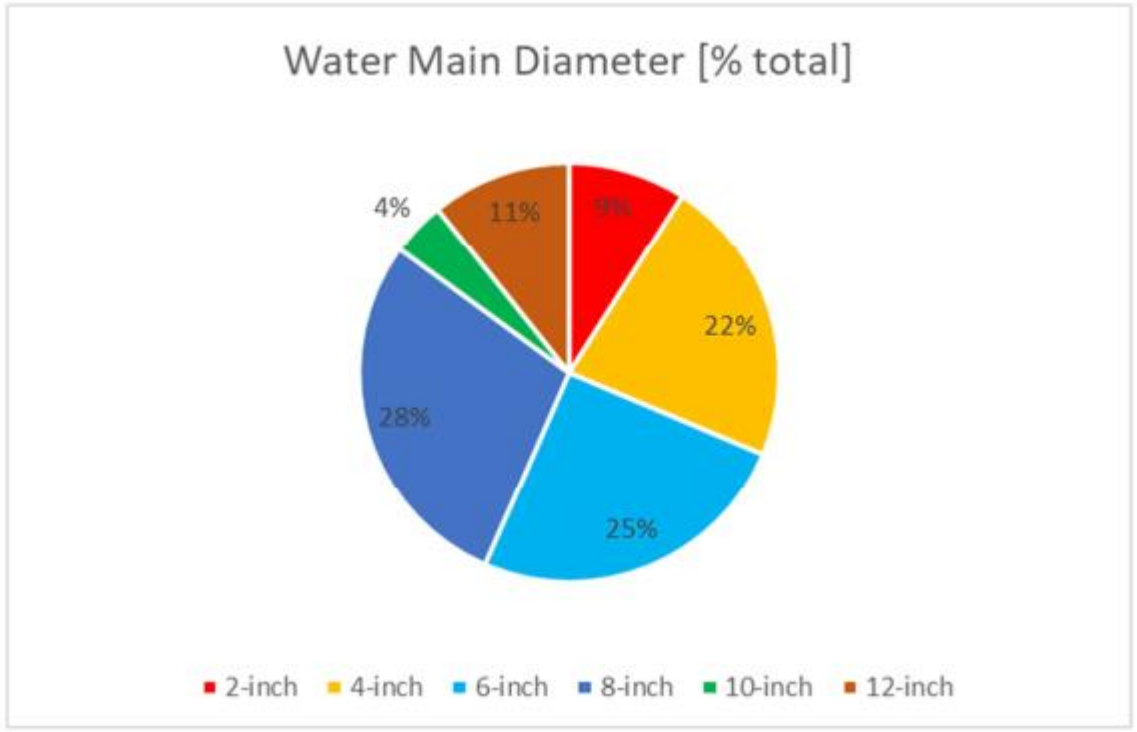
6. Regulatory Compliance (cont.)

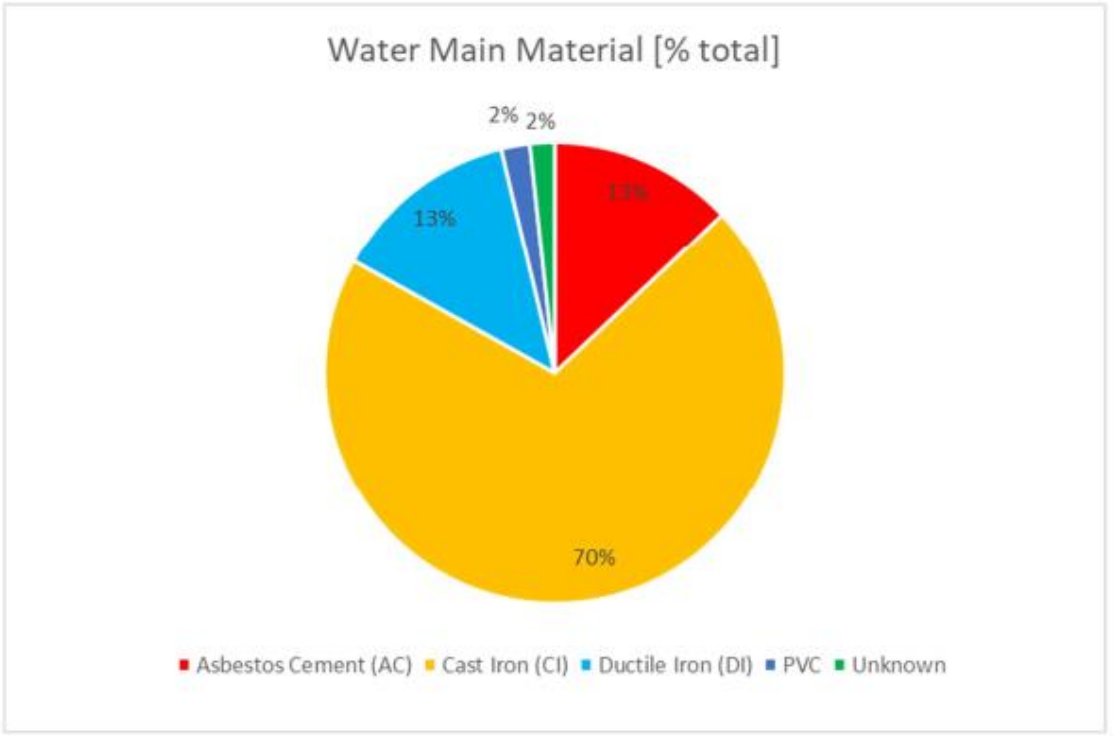
- Disinfection Byproduct Rule
  - There have been no MCL exceedances since 2018



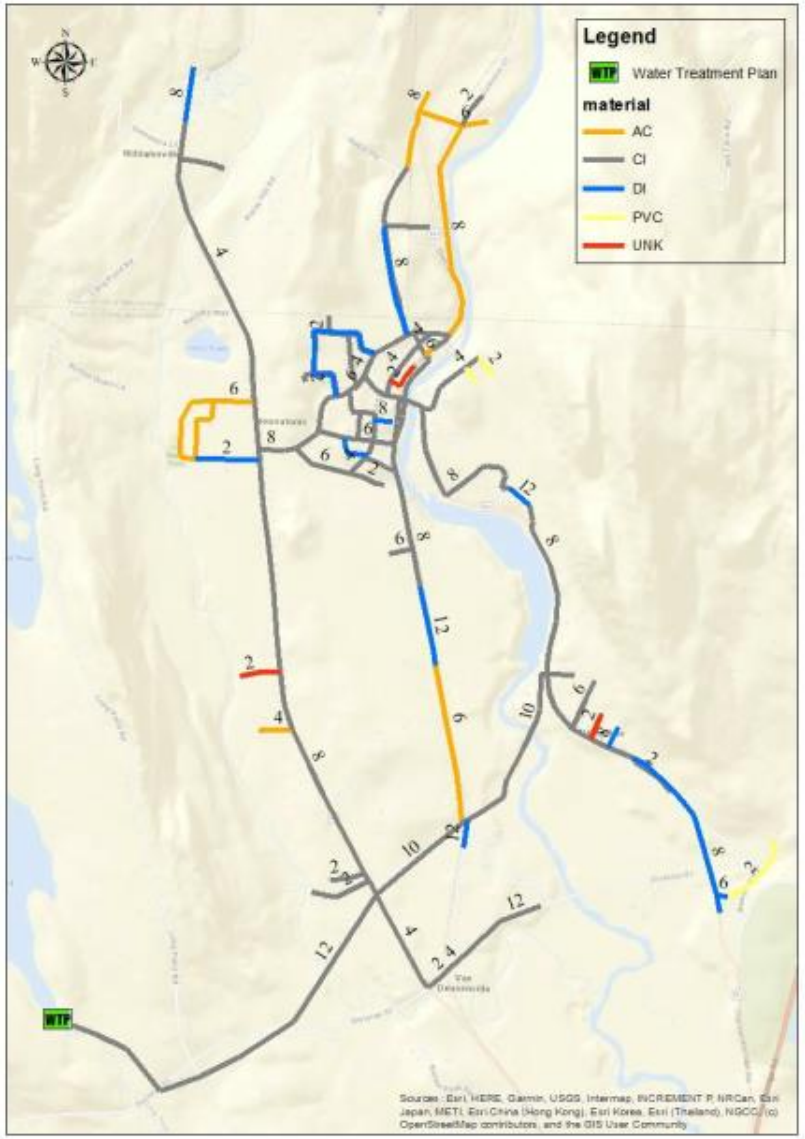
7. Distribution System

- As part of this evaluation, a hydraulic model was constructed using a water system map and water demand data provided by Housatonic Water Works
  - Most mains are cast iron in the 4” to 8” diameter range





Existing Distribution System Pipe Sizes and Materials



Hydraulic Model Scenarios

- Existing Average Day Demand (ADD) and Maximum Day Demand (MDD) conditions for the hydraulic analysis were calculated based on demand data from 2014
- The future ADD is based on the safe yield of Long Pond and the future MDD was calculated based on the current MDD to ADD ratio.
- Demand trends have been flat or downward since 2014

Scenario No.:	Simulated Flow from WTP	Flow (MGD)
Scenario 1	Existing ADD	Q = 0.21 MGD
Scenario 2	Existing MDD	Q = 0.30 MGD
Scenario 3	Future ADD	Q = 0.27 MGD
Scenario 4	Future MDD	Q = 0.39 MGD

Hydraulic Model Results - Pressure

- The model results showed there are no locations under 30 psi and only limited locations below 40 psi primarily due to elevation

Pressure distribution: Existing ADD 0.21 MGD

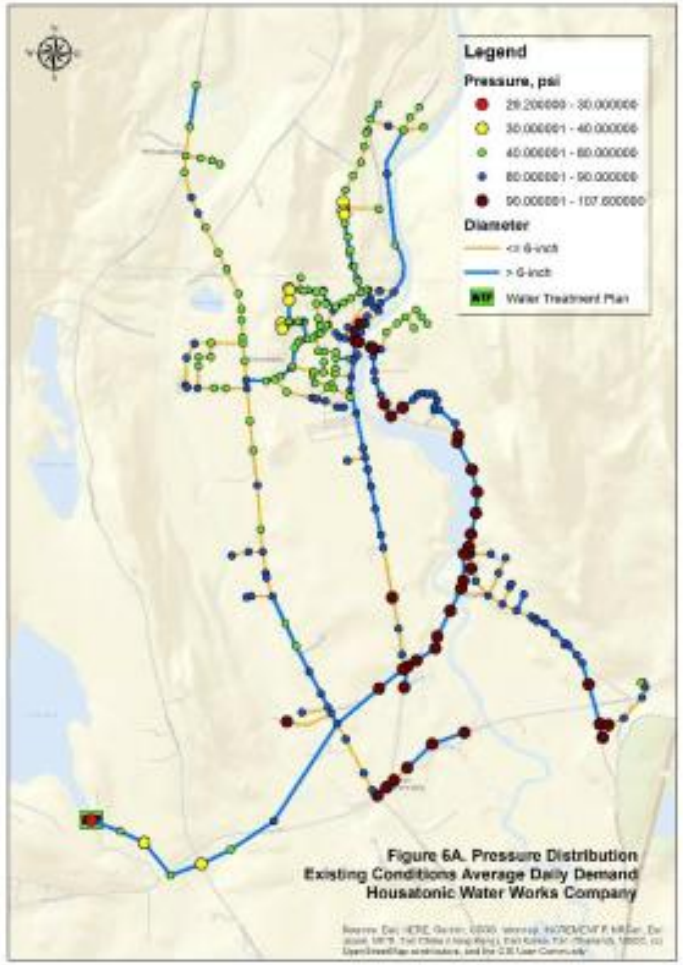


Figure 6A. Pressure Distribution
Existing Conditions Average Daily Demand
Housatonic Water Works Company

Pressure distribution: Existing MDD 0.30 MGD

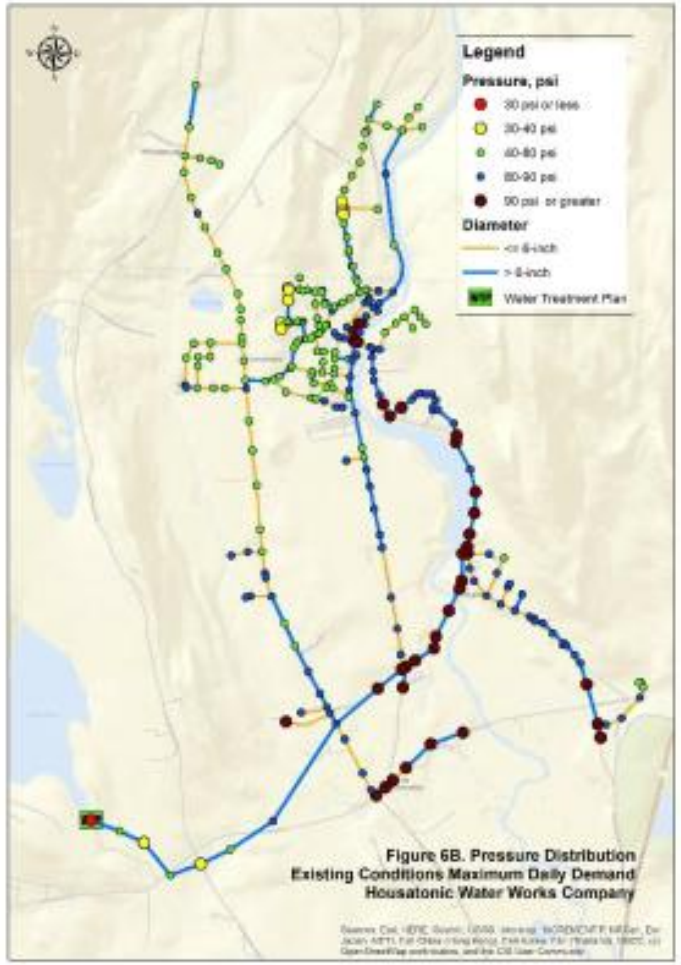


Figure 6B. Pressure Distribution
Existing Conditions Maximum Daily Demand
Housatonic Water Works Company

Hydraulic Model Results – Fire Flow

- The model results showed most (>90%) of the system does not have 500 gpm of available fire flow.

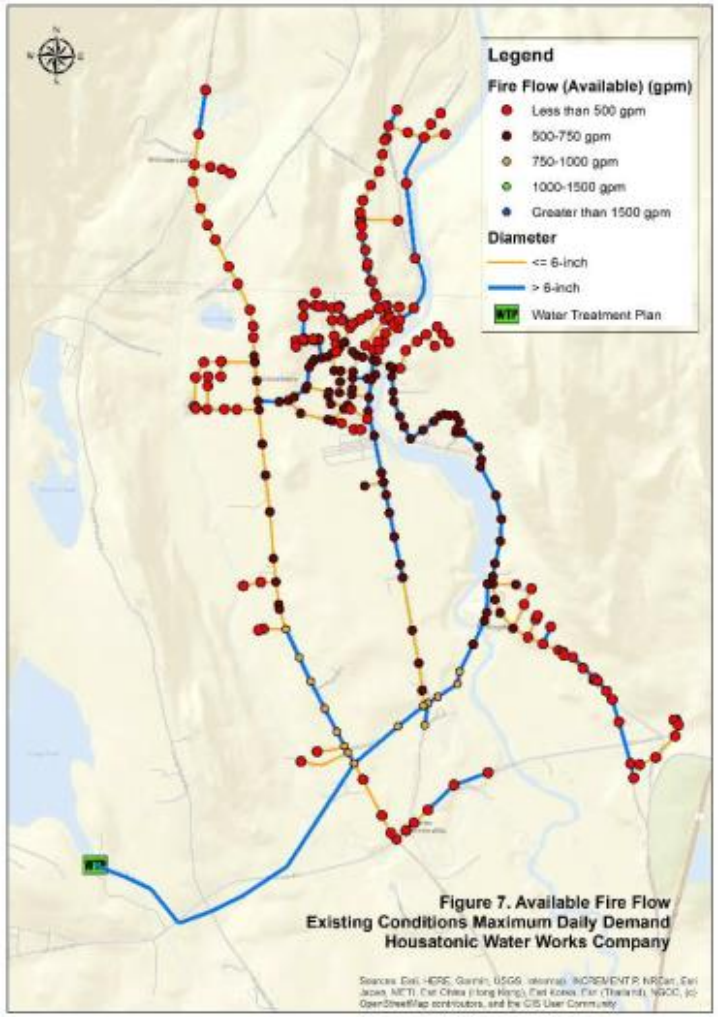


Figure 7. Available Fire Flow
Existing Conditions Maximum Daily Demand
Housatonic Water Works Company

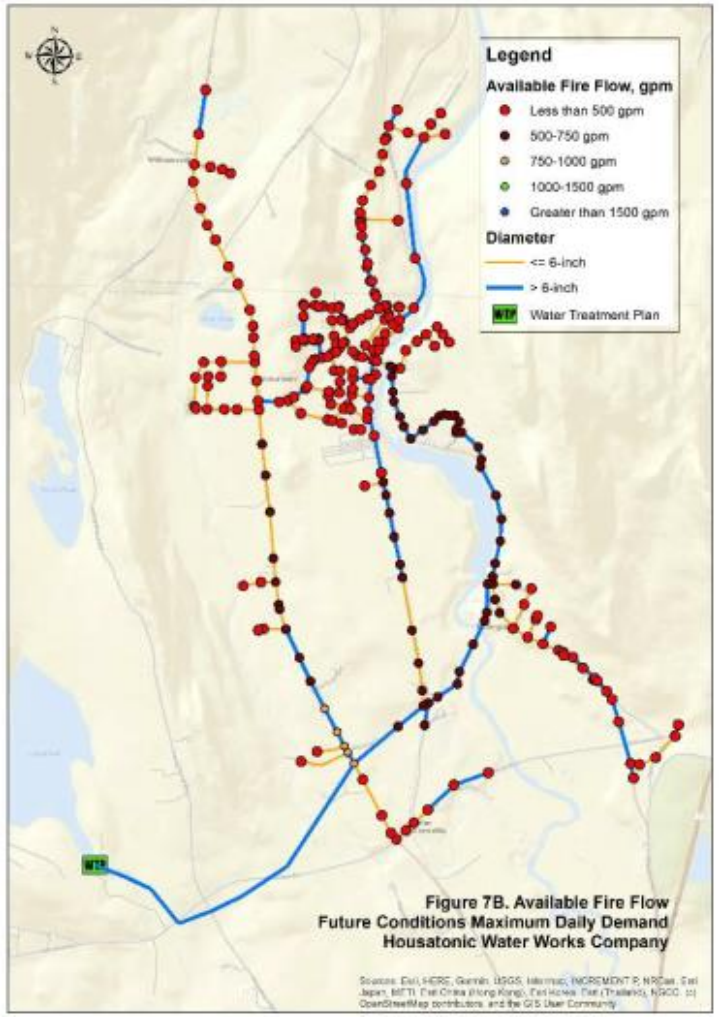


Figure 7B. Available Fire Flow
Future Conditions Maximum Daily Demand
Housatonic Water Works Company

8. Recommendations and Capital Improvement Plant

- Construction of a New Water Treatment Plant
- Pipeline Replacement Program
- Capital Improvement Plan

Construction of a New Water Treatment Plant

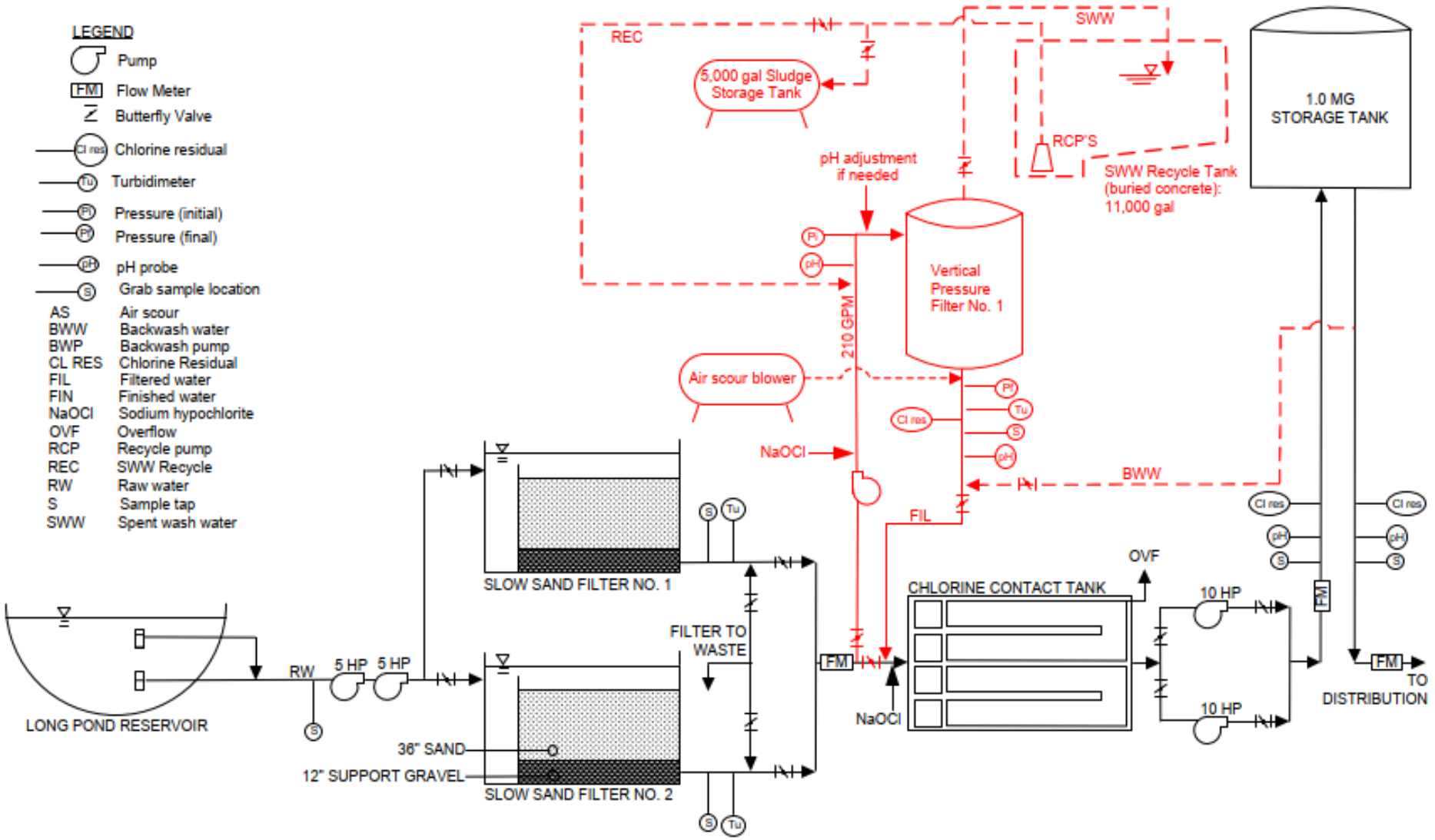
- Phase 1 – Supplemental Adsorptive Media Filter and New Treatment Building
  - Addresses the seasonal manganese issues
  - Construction of a new building sized for future processes
- Phase 2 – Additional Adsorptive Media Filter and Ion Exchange Process
  - Installation of processes to replace slow sand filters

Construction of a New Water Treatment Plant

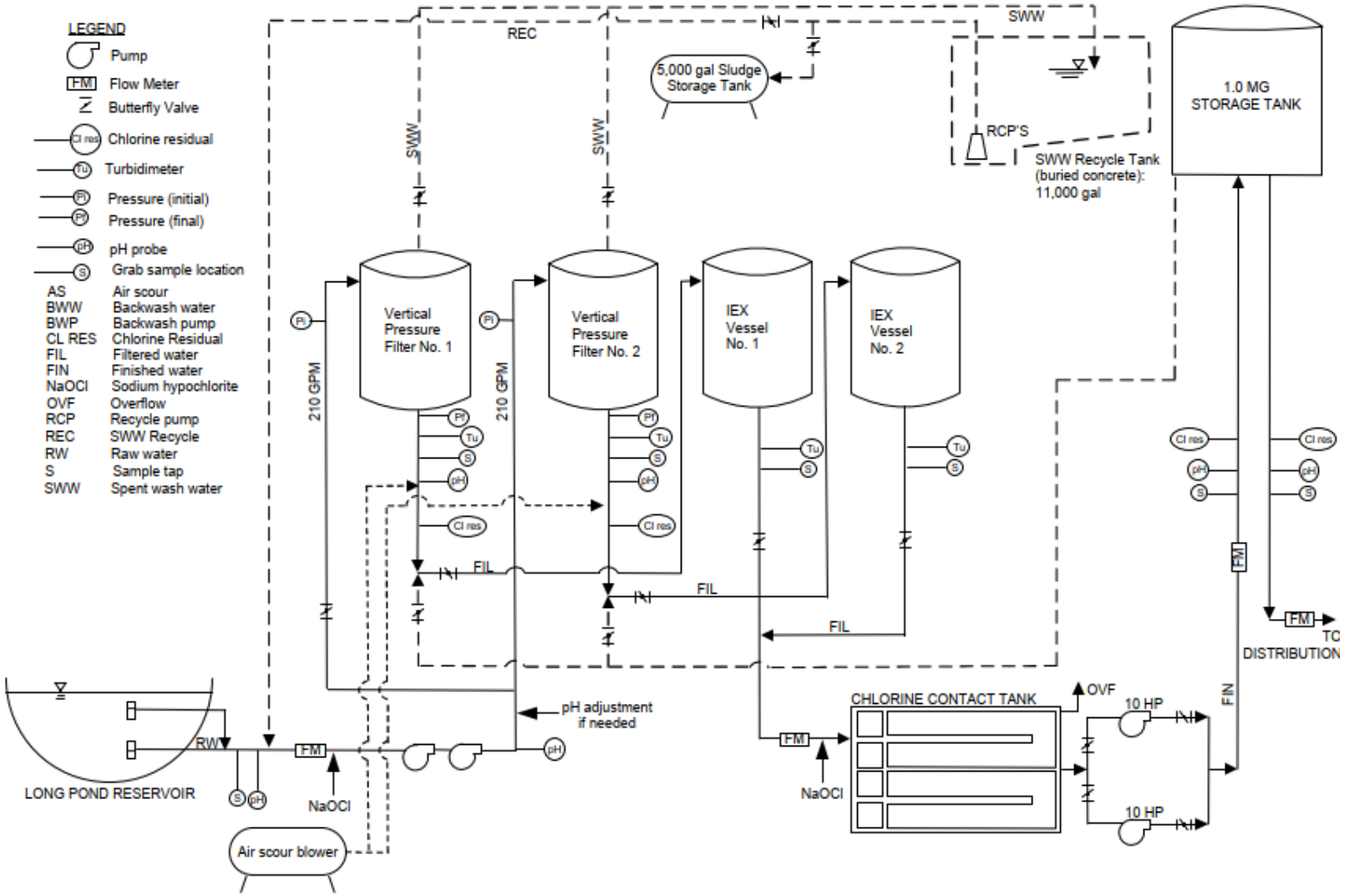
Parameter	Units	Flow Capacity for New Treatment Plant
Total Plant Flow Rate	MGD	0.6 MGD
Number of Process Trains		2 (1 operating and 1 standby)
Flow Rate for Each Process Train	MGD	0.3 MGD
Pressure Filtration with Greendsand Media		
Filter Surface Loading Rate	gpm/sf	3.0 gpm/sf
Working Pressure	Psi	100
Vessel Diameter	Feet	9.5
Side Shell	Feet	6
Greensand Media Depth	Inches	18
Anthracite Media Depth	Inches	12
Gravel Depth	Inches	15
IEX Process		
Vessel Loading Rate	gpm/sf	7.4
Working Pressure	Psi	100
Vessel Diameter	Feet	6
Vessel Height	Feet	11.9
Resin Depth	Inches	36
Gravel Depth	Inches	15
Anticipated Raw Water Quality		
Manganese	mg/L	0.00 – 0.10
Total Organic Carbon	mg/L	2.50 – 4.50
Color	c.u.	5 – 20

Figure 4-13: Proposed Location of new WTP

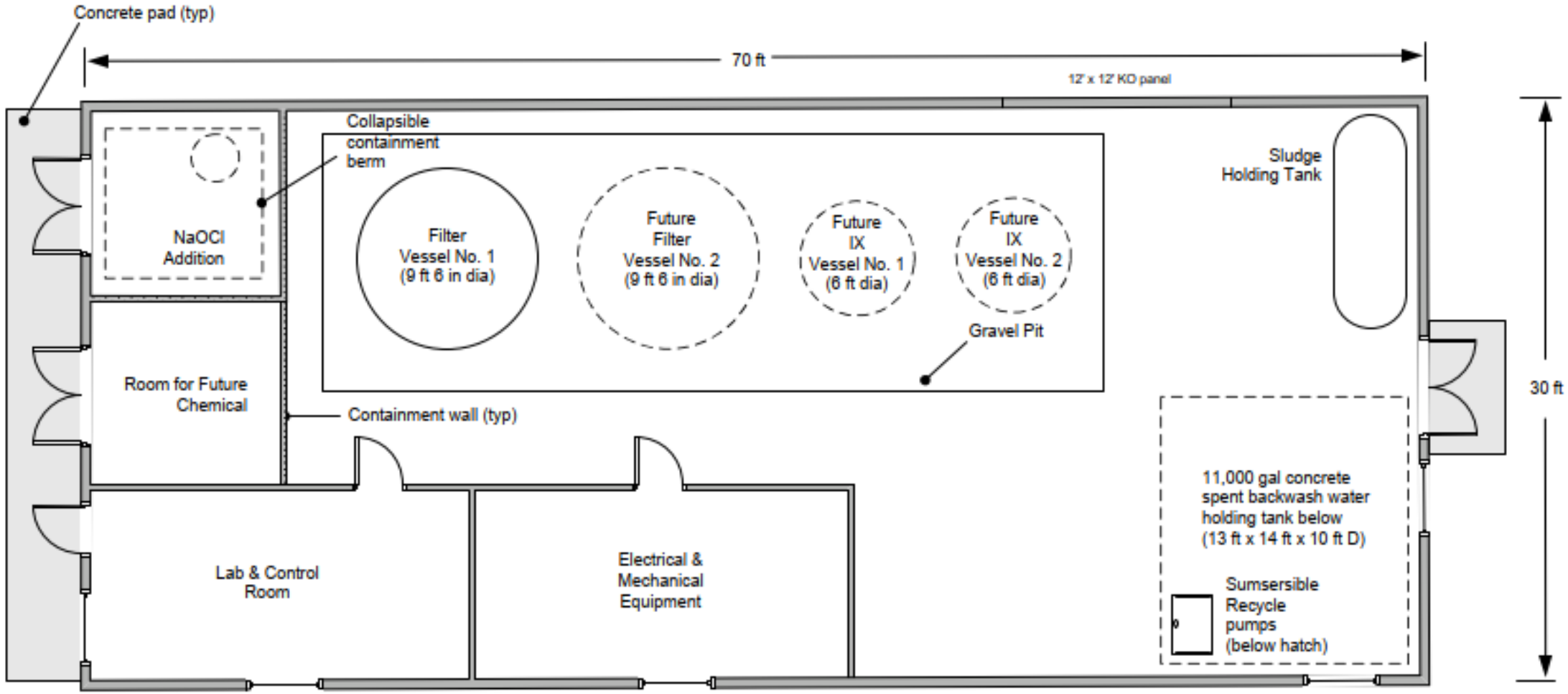
Proposed New Water Treatment Plant – Phase 1



Proposed New Water Treatment Plant – Phase 2



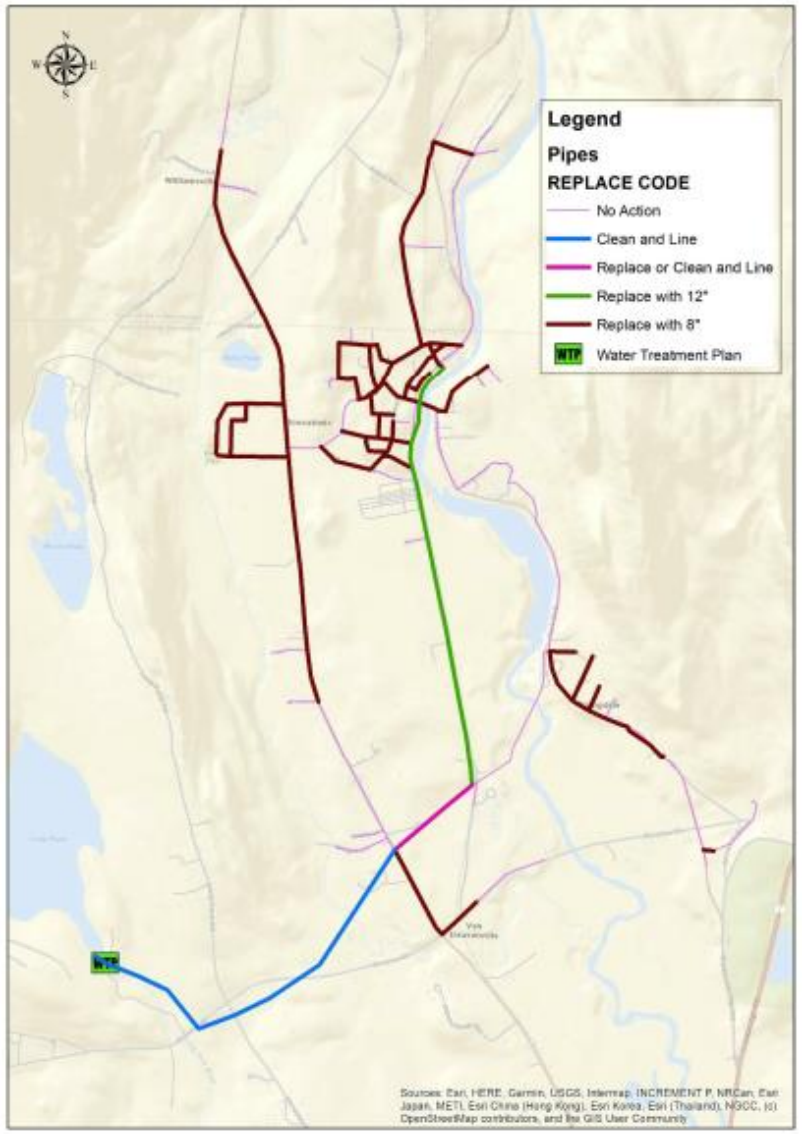
Proposed New Water Treatment Plant – Site Plan



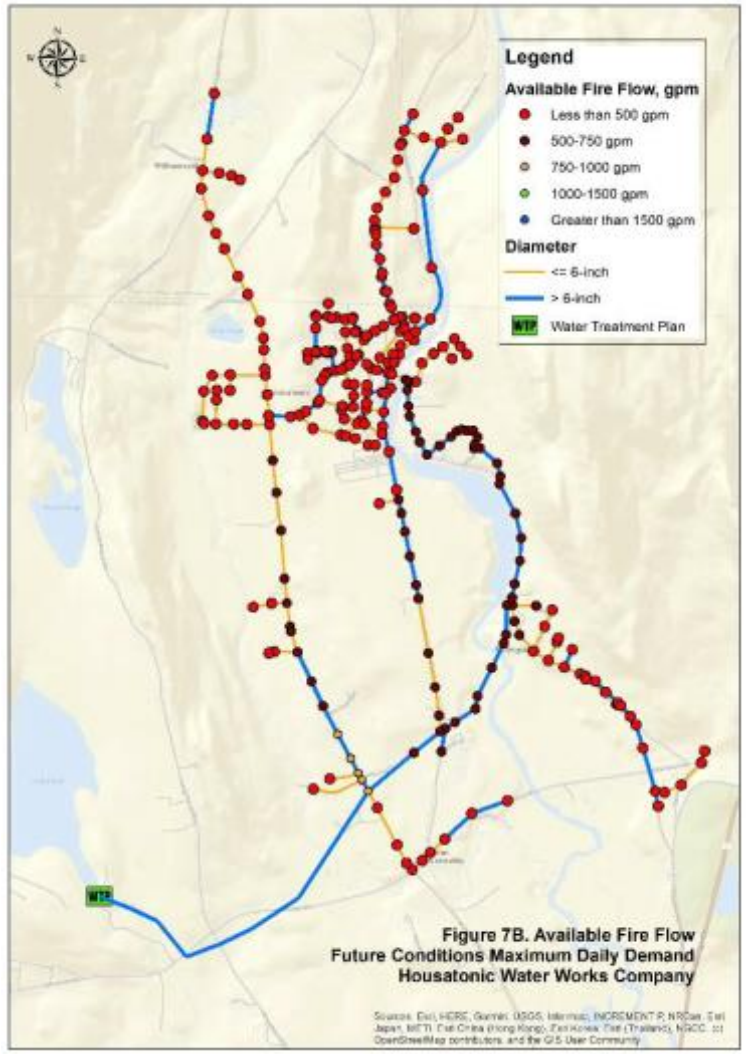
Pipeline Replacement Program

Size of Existing Main	Recommended Size	Recommended Action	Length, feet
2	8	Replace	3,332
4	8	Replace	20,709
6	8	Replace	25,266
8	12	Replace	6,794
10	12	Replace	1,880
12 (Easement between N. Plain Rd and Van Deusenville Rd.)	12	Replace or Clean and Line	1,378
12 (Pipe from WTP)	12	Clean and Line	7,336
Total Pipe Affected			66,695

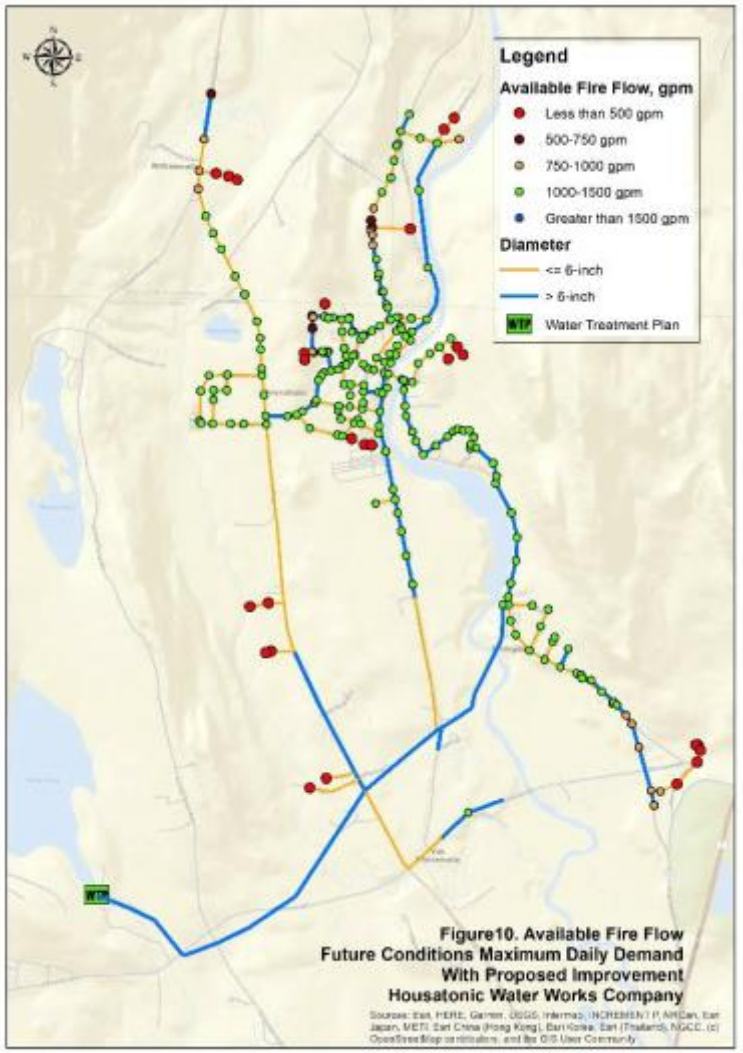
Proposed Pipeline Replacement Program



Pipeline Replace Program Affect on Fire Flow



Without Pipeline Improvements



With Pipeline Improvements

Pipeline Replace Program Affect on Fire Flow

Future Maximum Daily Demand Conditions Without Pipeline Improvements

Scenario No.:	Simulated Flow from WTP	Number of Junctions with AFF < 750 gpm	% of System Junctions (273)	Number of Junctions with AFF < 500 gpm	% of System Junctions (273)
Scenario 2	Existing MDD (0.30 MGD)	258	94.5%	158	57.9%
Scenario 4	Future MDD (0.39 MGD)	268	98.2%	207	75.8%

Future Maximum Daily Demand Conditions With Pipeline Improvements

Scenario No.:	Simulated Flow from WTP	Number of Junctions with AFF < 750 gpm	% of System Junctions (273)	Number of Junctions with AFF < 500 gpm	% of System Junctions (273)
Scenario 2	Existing MDD (0.30 MGD)	29	10.6%	26	9.5%
Scenario 4	Future MDD (0.39 MGD)	31	11.4%	26	9.5%

Capital Improvement Plan

Item	Estimated Construction Cost (2021 $)	Estimated Engineering and Owner's Contingency (40%)	Estimated Total Project Cost (2021 $)	Recommended Timeframe for Improvements		
				0-5 Years	6-10 Years	11-20 Years
Water Supply						
Analysis of spillway capacity		$7,500	$7,500	$7,500		
Remove trees around Long Pond Dam	$6,000	$2,000	$8,000	$8,000		
Remove, repair or replace training wall	$20,000	$8,000	$28,000	$28,000		
Water Treatment						
Installation of a mixing system in the 1.0 MG Storage Tank	$50,000	$20,000	$70,000	$70,000		
Replacement of sodium hypochlorite day tank with one with graduations and a clear calibration tube	$500	$200	$700	$700		
Installation of onsite emergency generator to power two 10 HP pumps in event of a power failure	$150,000	$60,000	$210,000	$210,000		
Replace the existing utility pole on the property	$10,000	$4,000	$14,000	$14,000		
Install a combined filtered effluent turbidimeter and incorporate a high turbidity alarm into the plant's SCADA system	$15,000	$6,000	$21,000	$21,000		
Incorporate a high and low point of entry chlorine residual alarm into the plant's SCADA system	$3,000	$1,000	$4,000	$4,000		
Conduct pilot study to evaluate proposed treatment technologies		$300,000	$300,000	$300,000		
Phase 1: Supplemental Greensand Filter and New Treatment Building	$1,000,000	$400,000	$1,400,000	$1,400,000		
Phase 2: Additional Greensand Filter and IEX Process	$1,100,000	$440,000	$1,540,000	$1,540,000		
Upgrade electric service to 480-volt for new WTP	$100,000	$40,000	$140,000	$140,000		
Water Distribution						
Replacement of 49,307 LF of 2", 4" and 6" with 8" Water Main	$15,000,000	$6,000,000	$21,000,000	$10,500,000	$10,500,000	
Replacement of 8,674 LF of 8" and 10" with 12" Water Main	$2,700,000	$1,080,000	$3,780,000		$3,780,000	
Clean and Line 8,714 LF 12" Water Main	$1,800,000	$720,000	$2,520,000			$2,520,000
Further Studies and Investigations						
Identify the location of both intakes to the WTP and decommission the shallower of the two intakes		$10,000	$10,000	$10,000		
Total	**$21,955,000**	**$9,099,000**	**$31,053,000**	**$14,253,000**	**$14,280,000**	**$2,520,000**